

The opinion in support of the decision entered today was not written
for publication and is not binding precedent of the Board.

Paper No. 24

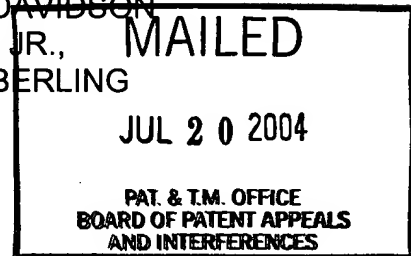
UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte RICHARD B. HOOK, JOHN M. DAVIDSON
ERIC J. KRESS, JACK W. SMITH, JR.,
JAMES W. STEGMAIER, PAUL V. HEBERLING
and DAVID B. PATTERSON

Appeal No. 2003-0567
Application No. 09/545,554

ON BRIEF



Before STAAB, MCQUADE, and NASE, Administrative Patent Judges.

STAAB, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on an appeal from the examiner's final rejection of claims 1-6 and
8-20, all the claims currently pending in the application.

Appellants' invention pertains to a method for operating a gas turbine engine combustor (claims 1-5), a combustor system for a gas turbine engine (claims 6 and 8-13), and a gas turbine engine (claims 14-20). An understanding of the invention can be derived from a reading of exemplary claims 1, 6 and 14, which appear in the appendix to appellants' main brief.

The references of record relied upon by the examiner as evidence of obviousness are:

Borkowicz et al. (Borkowicz)	5,259,184	Nov. 9, 1993
Horner et al. (Horner)	5,274,995	Jan. 4, 1994
Joshi et al. (Joshi)	5,351,477	Oct. 4, 1994
Talabisco et al. (Talabisco)	5,357,741	Oct. 25, 1994
Schilling et al. (Schilling)	5,630,319	May 20, 1997

The following rejections under 35 U.S.C. § 103(a) are before us for review:¹

(1) claims 1-4, 6, 8-11 and 15-17, rejected as being unpatentable over Schilling in view of Joshi and further in view of Horner or Borkowicz;

(2) claims 5, 12-14 and 18-20, rejected as being unpatentable over Schilling in view of Joshi and either Horner or Borkowicz as applied in the rejection of claim 1 et al., and further in view of Talabisco.²

¹The examiner has not expressly recited Joshi in the statement of either of the rejections under § 103. Nonetheless, it is clear from the record that both the examiner and appellants understand this reference as being part of the evidentiary basis for the rejections. See, for example, page 3 of the answer and page 16 of the main brief. Hence, for purposes of completeness, we have included Joshi in the statement of each of the standing rejections.

²Maslak, relied upon in the final rejection of claims 5, 12-14 and 18-20, has been
(continued...)

Reference is made to appellants' main and reply briefs (Paper Nos. 19 and 21) and to the examiner's answer (Paper No. 20) for the respective positions of appellants and the examiner regarding the merits of these rejections.

Discussion

Grouping of Claims

Appellants expressly state on page 13 of the main brief that claims 1-5 stand or fall together as a first group, that claims 6 and 8-13 stand or fall together as a second group, and that claims 14-20 stand or fall together as a third group.³ Consistent with appellants' grouping of claims, we select independent claim 1 as being representative of the first group, with dependent claims 2-5 standing or falling therewith, independent claim 6 as being representative of the second group, with dependent claims 8-13 standing or falling therewith, and independent claim 14 as being representative of the third group, with dependent claims 15-20 as standing or falling therewith.⁴

²(...continued)
withdrawn by the examiner in the answer as being cumulative. See page 2 of the answer.

³We appreciate that these groups do not correspond to the claims as grouped according to the various grounds of rejection maintained thereagainst.

⁴In considering this matter, we recognize that appellants have made reference to each of the dependent claims in the main brief (see, for example, pages 27-29 where the specifics of dependent claims 2-4 are set forth) and stated in cursory fashion that the subject matter recited in each dependent claim, when considered in combination with the base claim from which it depends, is not taught or suggested by the applied prior art. We do not consider these statements, which in effect merely point out

(continued...)

The Applied Prior Art

Schilling pertains to a multiple annular combustor comprising a plurality of domes, wherein the heat shields 166, 167, 168 for the domes are mechanically attached to the dome plate instead of being brazed thereto in order to facilitate assembly and disassembly (column 3, lines 40-47). Of particular interest in the present case is the sentence spanning columns 2 and 3 of Schilling, which reads as follows:

Since combustion apparatus 25 is predicated on an extremely well mixed flame, air/fuel mixers are preferably in accordance with that disclosed in U.S. Pat. No. 5,351,477, entitled "Dual Fuel Mixer for Gas Turbine Combustor," which is also owned by the assignee of the present invention and is hereby incorporated by reference.

Hence, it is clear that the disclosure of U.S. Pat. No. 5,351,477 should be taken into account in considering the teachings of Schilling.

Joshi is the aforementioned '477 patent incorporated by reference into Schilling. The Background section of Joshi (column 1, lines 14-35) indicates that the reduction of gas turbine pollutant emissions such as NO_x is a matter of concern in the design of gas turbine engines, and that prior to Joshi several measures have been used to reduce such emissions. As explained at column 1, lines 21-46:

Reductions in gas turbine emissions of NO_x have been obtained by the reduction of flame temperatures in the combustor, such as through the injection of high purity water or steam in the combustor. Additionally, exhaust gas emissions have been reduced through measures such as selective catalytic reduction. While both the wet techniques (water/steam

⁴(...continued)
differences in what the claims cover, to be arguments as to why the dependent claims are separately patentable.

injection) and selective catalytic reduction have proven themselves in the field, both of these techniques require extensive use of ancillary equipment. Obviously, this drives the cost of energy production higher. Other techniques for the reduction of gas turbine emissions include "rich burnt quick quench, lean burn" and "lean premix" combustion, where the fuel is burned at a lower temperature.

It is an objective of Joshi to provide a dual fuel mixer for a gas turbine combustor that uniformly mixes the air and fuel so as to produce minimal formation of pollutants when the fuel/air mixture is ignited in the combustor (column 2, lines 55-58). Concerning the dual fuel mixer, Joshi states (column 6, lines 4-12) that the swirlers 26 and 28 are designed to pass a specified amount of air flow and that the gas fuel manifold 35 and liquid fuel manifold 40 are sized to permit a specified amount of fuel flow so as to result in a "lean" premixture of fuel and air, that is, the fuel/air mixture contains more air than is required to fully combust the fuel, or an equivalence ratio of less than one.

Horner discloses an apparatus and method for injecting water in a combustor dome assembly of a gas turbine engine. As explained in the Background section of Horner (column 1, lines 16-48), it was known in the design of gas turbine engines to diminish undesirable emissions such as CO and NO_x by injecting water into the combustor to reduce the temperature therein, but that typically the water would exit the downstream end of the air/fuel mixer as relatively large droplets that would sometimes impact or impinge on various components of the combustor, causing thermal distress and erosion. It is an objective of Horner to alleviate this problem by atomizing the water into small particles before it can radially disperse and impact on the components of the combustor

downstream of the air/fuel mixer (column 1, lines 51-57; column 3, line 66 through column 4, line 3; column 4, lines 31-35).

Borkowicz pertains to a low NO_x combustor for a gas turbine. The combustor is a single stage (single combustion chamber or burning zone) dual mode combustor that operates in a diffusion mode at low turbine loads and in a premixed mode at high turbine loads (column 2, lines 20-26). Figures 2-4 illustrate a fuel nozzle for the combustor. As explained at column 6, line 3 through column 7, line 6, when operating in the diffusion mode, fuel from inlet 80 passes through passage 74 for discharge via orifice 78 into the combustion chamber 70 where it mixes with air discharged from passage 84 via orifice 88. When operating in the premixed mode, fuel from inlet 62 passes through premix passage 60 into radial injectors 66 and out passages 68 where it mixes with air swirled by annular swirlers 50. The fuel/air mixture then travels downstream to the combustion chamber 70 where it is ignited. An optional nozzle passage 94 may be provided to supply water to the burning zone to effect NO_x reductions in a manner well understood by those skilled in the art (column 3, lines 48-50; column 6, lines 41-47).

Talabisco discloses a method and apparatus for maintaining a substantially constant level of NO_x and minimizing CO emissions from a gas turbine. The emission levels are maintained by injecting a calculated amount of steam into the combustion chamber of the gas turbine. The amount of steam injected is varied based on, among other things, turbine load, which is a function of the turbine firing temperature (abstract).

The merits of the rejections

Looking first at the examiner's rejection of claim 1 as being unpatentable over Schilling in view of Joshi and further in view of Horner or Borkowicz, claim 1 is directed to a method of operating a gas turbine engine combustor of a gas turbine engine and includes the step of supplying at least one combustor dome a fuel/air mixture equivalence ratio less than one, and supplying at least one of water and steam into the gas turbine engine such that at least one of water and steam is injected into the combustor.

In rejecting claim 1, the examiner found, and appellants do not dispute, that Schilling, by virtue of its incorporation by reference of Joshi, discloses a method of operating a gas turbine engine combustor that includes the step of supplying at least one combustor dome a fuel/air mixture equivalence ratio less than one. The examiner considered that Schilling does not teach the step of injecting at least one of water and steam into the combustor of the gas turbine engine, but found that both Horner and Borkowicz taught this step. Based on the applied reference teachings, the examiner reasonably concluded that it would have been obvious to one of ordinary skill in the art to employ water/steam injection in conjunction with the premixers of Schilling/Joshi in order to lower NO_x emissions and/or CO emissions as taught by either Horner or Borkowicz.

Appellants' arguments have been considered but are not persuasive that the examiner erred in rejecting claim 1. The argument that the proposed combination is based on impermissible hindsight knowledge (e.g., pages 19 through 21 in the main brief) is not persuasive because it is predicated on the individual deficiencies of the applied

references vis-à-vis the claimed invention. Non-obviousness cannot be established, however, by attacking the references individually where the rejection is based upon the teachings of a combination of references. *In re Merck & Co. Inc.*, 800 F.2d 1091, 1097, 231 USPQ 375, 380 (Fed. Cir. 1986). The argument that the applied references do not teach, suggest, or provide any incentive for making the claimed combination (e.g., pages 18 and 21 of the main brief) also is not well taken. In this regard, we are in full agreement with the examiner's position as expressed on page 6 of the answer that the teachings of both Horner and Borkowicz are clear that water/steam injection into the pre-mixer of a gas turbine combustor is an effective way to lower the level of undesirable emissions (see, for example, Horner, column 3, lines 31-37 and column 5, lines 12-16; Borkowicz, column 3, lines 48-50 and column 6, lines 41-47) and that these teachings would have provided a clear incentive for one of ordinary skill in the art to provide water injection in Schilling/Joshi in order to achieve these benefits.

The argument that the applied references "teach away" from the claimed subject matter (e.g., pages 19-20 of the main brief) likewise is not well taken. A reference will teach away only if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the results sought by the inventor. *In re Gurley*, 27 F.3d 551, 553, 31 USPQ2d 1130, 1132 (Fed. Cir. 1994). From a review of the disclosures of Schilling and Joshi, it is clear that these references do not "teach away" from using water injection in conjunction with a "lean" fuel/air mixture to reduce undesirable emissions. In particular, the discussion at column 1, lines 27-31 of Joshi

referred to by appellants on page 25 of the main brief merely indicates what the ordinarily skilled artisan would most likely already know, namely, that there is a tradeoff in the form of higher initial and operating costs that must be made in order to attain the advantage of lower emissions that water injection provides. Similarly, the discussion at column 1, lines 56-59 of Joshi referred to by appellants on page 25 of the main brief simply indicates that "prior art" lean burn designs, i.e., those prior to Joshi's design, had flashback and auto-ignition problems. Neither of these discussions in Joshi "teach away" from the claimed combination of using water injection in conjunction with a "lean" fuel/air mixture. Horner and Borkowicz also do not "teach away" from the claimed subject matter, since neither one of these references teaches, either expressly or impliedly, that it is undesirable to combine water/steam injection with lean burn fuel/air design to lower undesirable emissions.

In light of the foregoing, we shall sustain the standing § 103 rejection of independent claim 1. We also shall sustain the standing § 103 rejection of claims 2-5 since, as noted above, appellants have (1) expressly stated on page 13 of the main brief that claims 1-5 should stand or fall together, and (2) not argued with any reasonable degree of specificity why these dependent claims are separately patentable.

Turning to the examiner's rejection of claim 6 as being unpatentable over Schilling in view of Joshi and further in view of Horner or Borkowicz, claim 6 is directed to a combustor system for a gas turbine engine, wherein the combustor system comprises at least one combustor dome configured to operate with a fuel/air mixture equivalent ratio

less than one, and a water delivery sub-system connected to the engine configured to supply at least one of water and steam to the combustor. The examiner's rejection of claim 6 is essentially the same as that of claim 1, and appellants' arguments in favor of the patentability of claim 6 likewise are the same as those advanced in favor of claim 1. Accordingly, for the reasons set above in our discussion of claim 1, we shall sustain the rejection of claim 6. It follows that we also shall sustain the standing § 103 rejection of claims 8-13 since appellants have expressly stated that claims 6 and 8-13 should stand or fall together, and have not argued with any reasonable degree of specificity why dependent claims 8-13 are separately patentable.

Considering finally the examiner's rejection of claim 14 as being unpatentable over Schilling in view of Joshi and either Horner or Borkowicz and further in view of Talabisco, claim 14 calls for a gas turbine engine comprising a combustion system comprising a lean burn premix combustor and a water delivery sub-system.⁵ The examiner's rejection of claim 14 tracks that of claim 1, and appellants' arguments in favor of the patentability of claim 14 are essentially the same as those advanced in favor of claim 1. Under these circumstances, we shall sustain the standing rejection of claim 14 for the reasons set above in our discussion of claim 1. We also shall sustain the standing § 103 rejection of claims 15-20 since appellants have expressly stated that claims 14-20 should stand or fall

⁵In that claim 14 does not include any limitation calling the water delivery sub-system to be selectively operable in first and second operating modes, it is not clear why the examiner included Talabisco in the statement of the rejection of this claim.

together, and have not argued with any reasonable degree of specificity why dependent claims 15-20 are separately patentable.

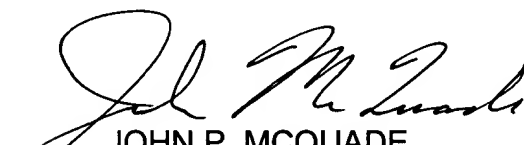
Conclusion

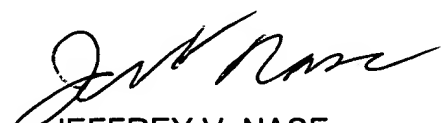
The decision of the examiner finally rejecting the appealed claims is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a).

AFFIRMED


LAWRENCE J. STAAB
Administrative Patent Judge


JOHN P. MCQUADE
Administrative Patent Judge


JEFFREY V. NASE
Administrative Patent Judge

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Appeal No. 2003-0567
Application No. 09/545,554

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JOHN S. BEULICK
C/O ARMSTRONG TEASDALE LLP
ONE METROPOLITAN SQUARE
SUITE 2600
ST. LOUIS MO 63102-2740